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EXAMINER

DICHT, RACHEL S

ART UNIT PAPER NUMBER

2853

DATE MAILED: 09/26/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

10/777,625

Applicant(s)

ISONO ET AL.

Examiner

Rachel Dicht

Art Unit

2853

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 12 February 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-40 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 32-35 is/are allowed.
- 6) ☒ Claim(s) 1-6, 10-14, 16, 25 and 36 is/are rejected.
- 7) ☒ Claim(s) 7-9, 15, 17-24, 26-31 and 37-40 is/are objected to.
- 8) ☒ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 12 February 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date 4/15/2004.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

**DETAILED ACTION**

***Claim Rejections - 35 USC § 102***

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1, 2, 3, 4, 6, 16 and 25 are rejected under 35 U.S.C. 102(b) as being anticipated by Takagi (US Pub. No. 2002/0024567).

In regard to:

Claim 1:

Takagi teaches an ink jet printer head, comprising: a cavity unit having a plurality of nozzles (15, Fig. 3) arranged in a reference direction, a plurality of pressure chambers (16, Fig. 1) which communicate with the nozzles, respectively, and a plurality of partition walls which separate the pressure chambers (walls between 16, Fig. 2) from each other; a piezoelectric actuator (20, Fig. 2) having a plurality of active portions each of which is driven to change a pressure of an ink accommodated in a corresponding one of the pressure chambers, and thereby eject, from a corresponding one of the nozzles, a droplet of the ink, the cavity unit and the piezoelectric actuator being fixed to each other; the piezoelectric actuator (20, Fig. 2) comprising a plurality of sheet members (21a, 21b, 21c, 21d, 21e, 21f, 21g, 22, and 23, Fig. 6) which are stacked on each other and include at least one piezoelectric sheet (refer to paragraph [0053]); at

least one common electrode (25, Fig. 6); and at least one individual-electrode layer (24, Fig. 6) including a plurality of individual electrodes which are aligned; with the pressure chambers, respectively, and each of which cooperates with a corresponding one of a plurality of portions of said at least one common electrode to sandwich a corresponding one of a plurality of portions of said at least one piezoelectric sheet, in a direction of stacking of the sheet members, and thereby provide a corresponding one of the active portions of the piezoelectric actuator (refer to paragraph [0053]); the piezoelectric actuator further comprising a plurality of external pads (31, Fig. 1) which are provide on an outer surface of an outermost sheet member of the sheet members and are electrically connected to a cable member (40, Fig. 1) through which drive signals for said active portions are transmitted; and a plurality of internal leads (30, Fig. 2) which electrically connect between the individual electrodes (24, Fig. 6) and the external pads (31, Fig. 1), respectively; and the external pads (31, Fig. 2) being located, on the outer surface of the outermost sheet member of the piezoelectric actuator, at respective positions that are at least partially aligned with the partition walls each of which is located between corresponding two pressure chamber (16, Fig. 2); of the plurality of pressure chambers in said reference direction (refer to paragraph [0060] and [0061]) (Fig. 2).

Claim 2:

Takagi teaches the printer head wherein the internal leads (30, Fig. 2) of the piezoelectric actuator (20, Fig. 2) are formed in respective through-holes (32, Fig. 2) formed through a thickness of the outermost sheet member (refer to paragraph [0060]).

Claim 3:

Takagi teaches the printer head wherein a length of each of the external pads (31, Fig. 2) is smaller than a length of each of the partition walls (walls between pressure chambers 16, Fig. 2).

Claim 4:

Takagi teaches the printer head wherein the piezoelectric actuator filter comprises a plurality of electrical conductors which are formed on the outer surface of the outermost sheet member of the piezoelectric actuator, and wherein the external pads (31, Fig. 2) are formed on the electrical conductors, respectively (refer to paragraph [0061]).

Claim 6:

Takagi teaches the printer head wherein the internal leads (31, Fig. 2) extend through a thickness of the outermost sheet member of the piezoelectric actuator (20, Fig. 2), wherein the electrical conductors are electrically connected

to the individual electrodes via the internal leads (25a, Fig. 5), respectively, and extend parallel to the pressure chambers (16, Fig. 1), respectively, in a direction perpendicular to the reference direction, and wherein the external pads (31, Fig. 2) are formed on the outer surface of the outermost sheet (23, Fig. 5) member of the piezoelectric actuator, such that each of the external pads partly overlaps a corresponding one of the electrical conductors (refer to paragraph [0061]).

Claim 16:

Takagi teaches an ink jet printer head, comprising: a cavity unit having a plurality of nozzles (15, Fig. 3) arranged in a first direction, and a plurality of pressure chambers (16, Fig. 3) which communicate with the nozzles, respectively; a piezoelectric actuator (20, Fig. 5) having a plurality of active portions (21a, 21b, 21c, 21d, 21e, 21f, 21g, 22, 23, Fig. 5) each of which is driven to change a pressure of an ink accommodated in a corresponding one of the pressure chambers, and thereby eject, from a corresponding one of the nozzles, a droplet of the ink, the cavity unit and the piezoelectric actuator being fixed to each other; the piezoelectric actuator comprising a plurality of sheet members (21a, 21b, 21c, 21d, 21e, 21f, 21g, 22, 23, Fig. 5) which are attached on each other and include at least one piezoelectric sheet (refer to paragraph [0053]); at least one common electrode (25, Fig. 5); and at least one individual-electrode layer (24, Fig. 5) inducing a plurality of individual electrodes which are aligned with the pressure chambers (16, Fig. 3) (refer to paragraph [0053]), respectively,

and each of which cooperates with a corresponding one of a plurality of portions of said at least one common electrode to sandwich a corresponding one of a plurality of portions of said at least one piezoelectric sheet (refer to paragraph [0053]) (Fig. 5), in a direction of stacking of the sheet members, and thereby provide a corresponding one of the active portions of the piezoelectric actuator; said at least one common electrode (25, Fig. 5) being provided on one of opposite planar surfaces of said at least one piezoelectric sheet (21g, Fig. 5), such that said at least one common electrode is elongate in the first direction (the length of the piezoelectric actuator 20, Fig. 6) and has a first edge line parallel to the first direction; and the piezoelectric actuator further comprising a plurality of first internal leads (32, Fig. 2) which extend through a thickness of said at least one piezoelectric sheet; and a plurality of first internal pads (26, Fig. 5) which are electrically connected to the individual electrodes (24, Fig. 5) via the first internal leads (32, Fig. 5), respectively, and which are provided on said one planar surface of said at least one piezoelectric sheet, such that each of the first internal pads (26, Fig. 5) is distant from the first edge line of said at least one common electrode (25, Fig. 5) by a first predetermined distance in a second direction perpendicular to the first direction, and extends in a third direction inclined by a first predetermined angle relative to the second direction.

Claim 25:

Takagi teaches an ink jet printer head, comprising: a cavity unit having a plurality of nozzles (15, Fig. 3) arranged in a first direction, and a plurality of pressure chambers (16, Fig. 3) which communicate with the nozzles, respectively and each of which is elongate in a second direction perpendicular to the first direction; a piezoelectric actuator (20, Fig. 5) having a plurality of active portions (21a, 21b, 21c, 21d, 21e, 21f, 21g, 22, 23, Fig. 5) each of which is driven to change a pressure of an ink accommodated in a corresponding one of the pressure chambers, and thereby eject, from a corresponding one of the nozzles, a droplet of the ink, the cavity unit and the piezoelectric actuator being fixed to each other; the piezoelectric actuator comprising a plurality of sheet members (21a, 21b, 21c, 21d, 21e, 21f, 21g, 22, 23, Fig. 5) which are stacked on each other and include at least one piezoelectric sheet (refer to paragraph [0053]) (Fig. 5); at least one common electrode (25, Fig. 5); and at least one individual-electrode layer (24, Fig. 5) including a plurality of individual electrodes which are aligned with the pressure chambers, respectively and each of which cooperates with a corresponding one of a plurality of portions of said at least one common electrode to sandwich a corresponding one of a plurality of portions of said at least one piezoelectric sheet, in a direction of stacking of the sheet members, and thereby provide a corresponding one of the active portions of the piezoelectric actuator; said at least one common electrode (25, Fig. 5) including a plurality of first electrically conductive portions (material filled in each through



hole 32, Fig. 5) each of which at least partly overlaps a corresponding one of the pressure chambers (16, Fig. 3), and is elongate in the second direction, and additionally including at least one second electrically conductive portion (30, Fig. 2) which extends in the first direction to connect respective one ends of the first conductive portions.

***Claim Rejections - 35 USC § 103***

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 5, 10, 11, 12, 13, 14, and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Takagi (US Pub. No. 2002/0024567) in view of Qiu et al. (US Pat. No. 6,142,615).

In regard to:

Claim 10:

Takagi teaches an ink jet printer head, comprising: a cavity unit having a plurality of nozzles (15, Fig. 3) arranged in a reference direction, and a plurality of pressure chambers (16, Fig. 3) which communicate with the nozzles, respectively, and which are grouped into at least two groups of pressure chambers each group of which consists of at least two pressure chambers arranged in the reference direction (16, Fig. 4); a piezoelectric actuator (20, Fig.

6) having a plurality of active portions each of which is driven to change a pressure of an ink accommodated in a corresponding one of the pressure chambers, and thereby eject, from a corresponding one of the nozzles, a droplet of the ink, the cavity unit and the piezoelectric actuator being fixed to each other, at least one common electrode (25, Fig. 6); and at least one individual-electrode layer (24, Fig. 6) inducing a plurality of individual electrodes which are aligned with said at least two pressure chambers of a corresponding one of said at least two groups of pressure chambers, respectively, and each of which cooperates with a corresponding one of a plurality of portions of said at least one common electrode to sandwich a corresponding one of a plurality of portions of said at least one piezoelectric sheet, in a direction of stacking of the sheet members, and thereby provide a corresponding one of the active portions of said each actuator portion; said each of said at least two actuator portions further comprising a plurality of external pads (31, Fig. 2) which are provided on an outer surface of an outermost sheet (23, Fig. 5) member of the sheet members, such that the external pads are arranged in the reference direction, and are electrically connected to a flat cable (refer to paragraph [0041]); and a plurality of internal leads (25a, Fig. 5) which electrically connect between the individual electrodes (24, Fig. 5) and the external pads (31, Fig. 5), respectively; and one of the external pads (31, Fig. 5) of said each actuator portion (20, Fig. 1) that is nearest to said one end of said each actuator portion in the reference direction being

more distant from said one end than one of the active portions of said each actuator portion that is nearest to said one end.

It is noted however, that Takagi fails to teach the piezoelectric actuator comprising at least two actuator portions each of which has a plurality of active portions and which are arranged next to each other in the reference direction such that respective one ends of said at least two actuator portions are opposed to each other in the reference direction, and such that said at least two actuator portions are opposed to said at least two groups of pressure chambers, respectively, said each of said at least two actuator portions comprising a plurality of sheet members which are stacked on each other and include at least one piezoelectric sheet

However, Qui et al. teaches the piezoelectric actuator comprising at least two actuator portions (4A and 4B, Fig. 5) each of which has a plurality of active portions (41 and 42, Fig. 1) and which are arranged next to each other (Fig. 5) in the reference direction such that respective one ends of said at least two actuator portions are opposed to each other in the reference direction, and such that said at least two actuator portions are opposed to said at least two groups of pressure chambers (21A and 21B, Fig. 5), respectively, said each of said at least two actuator portions comprising a plurality of sheet members which are stacked on each other and include at least one piezoelectric sheet (41 and 42, Fig. 1).

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Claim 11:

Takagi teaches the printer head wherein the external pads (31, Fig. 2) of said each actuator portion (20, Fig. 1) are arranged in at least one array at a predetermined regular interval of distance in the reference direction.

Claim 12:

Takagi teaches the printer head wherein the internal leads (30, Fig. 2) of the piezoelectric actuator (20, Fig. 2) are formed in respective through-holes (32, Fig. 2) formed through a thickness of the outermost sheet member (refer to paragraph [0060]).

Claim 13:

Takagi teaches the printer head wherein the piezoelectric actuator filter comprises a plurality of electrical conductors which are formed on the outer surface of the outermost sheet member of the piezoelectric actuator, and wherein the external pads (31, Fig. 2) are formed on the electrical conductors, respectively (refer to paragraph [0061]).

Claims 5 and 14:

Takagi teaches the claimed invention except for the printer head wherein the electrical conductors are formed, by printing and firing, on the outer surface of the outermost sheet member of the piezoelectric actuator, and wherein the

external pads are subsequently formed, by printing, on the electrical conductors, respectively. It would have been obvious to one having ordinary skill in the art at the time the invention was made to form the electrical conductors by printing and firing since it was known in the art that screen-printing can be used to form the electrodes.

Claim 36:

Takagi teaches an ink jet printer head, comprising; a cavity unit having a plurality of nozzles (15, Fig. 3) arranged in a first direction, and a plurality of pressure chambers (16, Fig. 3) which communicate with the nozzles, respectively, and which are grouped into at least two groups of pressure chambers each group of which consists of at least two pressure chambers arranged in the first direction; a piezoelectric actuator (20, Fig. 6) having a plurality of active portions each of which is driven to change a pressure of an ink accommodated in a corresponding one of the pressure chambers, and thereby eject, from a corresponding one of the nozzles, a droplet of the ink, the cavity unit and the piezoelectric actuator being fixed to each other; said each of said at least two actuator portions comprising a plurality of sheet members (21a, 21b, 21c, 21d, 21e, 21f, 21g, 22, 23, Fig. 5) which are stacked on each other and include at least one piezoelectric sheet; at least one common electrode (25, Fig. 6); and at least one individual-electrode layer (24, Fig. 6) including a plurality of individual electrodes which are aligned with said at least two pressure chambers of a

corresponding one of said at least two groups of pressure chambers, respectively, and each of which cooperates with a corresponding one of a plurality of portions of said at least one common electrode to sandwich a corresponding one of a plurality of portions of said at least one piezoelectric sheet, in a direction of stacking of the sheet members, and thereby provide a corresponding one of the active portions of said each actuator portion; said at least one common electrode (25, Fig. 6) being provided on one of opposite planar surfaces of said at least one piezoelectric sheet (21f, Fig. 6), such that said at least one common electrode (25, Fig. 6) is elongate in the first direction and has a first edge line parallel to the first direction; said each actuator portion further comprising a plurality of internal leads (25a, Fig. 5) which extend through a thickness of said at least one piezoelectric sheet; and a plurality of internal pads (26, Fig. 5) which are electrically connected to the individual electrodes (refer to paragraph [0060]).

It is noted however, that Takagi fails to teach the piezoelectric actuator comprising at least two actuator portions each of which has a plurality of active portions and which are arranged next to each other in the first direction such that respective one ends of said at least two actuator portions are opposed to each other in the first direction, and such that said at least two actuator portions are opposed to said at least two groups of pressure chambers, respectively.

However, Qui et al. teaches the piezoelectric actuator comprising at least two actuator portions (4A and 4B, Fig. 5) each of which has a plurality of active portions (41 and 42, Fig. 1) and which are arranged next to each other in the first direction such that respective one ends of said at least two actuator portions are opposed to each other in the first direction, and such that said at least two actuator portions are opposed to said at least two groups of pressure chambers (21A and 21B, Fig. 5), respectively.

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the device of Takagi to include at least two actuator portions as taught by Qui et al. for the purpose of having a higher piezoelectric constant thereby permitting more ink droplets to be ejected at a higher speed while applying a lower voltage.

***Allowable Subject Matter***

5. Claims 7-9, 15, 17, 18-24, 26-31, and 37-40 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.
6. Claims 32-35 are allowed.

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7. The following is a statement of reasons for the indication of allowable subject matter: The primary reason for the allowance of claims 32-35 is the inclusion of the limitation of:

Claim 32:

The piezoelectric actuator further comprising a plurality of first internal leads which extend through a thickness of said at least one piezoelectric sheet; and a plurality of internal pads which are electrically connected to the individual electrodes via the first internal leads, respectively, and which are provided on said one planar surface of said at least one piezoelectric sheet, such that each of the internal pads is distant from the first edge line of said at least one common electrode by a first predetermined distance in the second direction, and extends in a third direction inclined by a first predetermined angle relative to the second direction; the piezoelectric actuator further comprising a plurality of external pads which are provided on an outer surface of an outermost sheet member of the sheet members and are electrically connected to a cable member; and each of the individual electrodes including an end portion which extends in a fourth direction inclined by a second predetermined angle relative to the second direction, the end portion of said each individual electrode being connected to a corresponding one of the external pads via a corresponding one of the first internal leads and a corresponding one of the internal pads.



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It is these limitation found in each of the claims, as they are claimed in the combination, that has not been found, taught or suggested by the prior art of record which makes these claims allowable over the prior art.

**Contact Information**

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Rachel Dicht whose telephone number is 571-272-8544. The examiner can normally be reached on 7:00 am - 3:30 pm Monday through Friday.

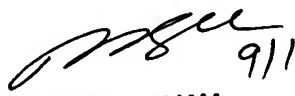
If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stephen Meier can be reached on 571-272-2149. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

RSD



August 31, 2005



9/16/05  
**MANISH S. SHAH**  
**PRIMARY EXAMINER**